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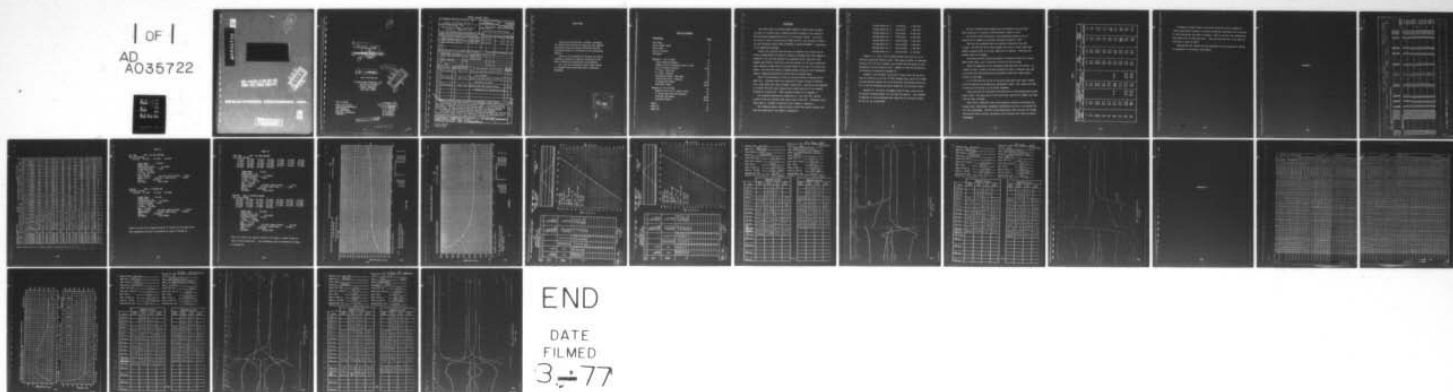
EAGLE-PICHER CO JOPLIN MO COUPLES DEPT
FINAL TECHNICAL REPORT FOR B. 494 /U, (U)
NOV 76 D H SPRACKLEN
4212-T-1176

F/G 10/3

UNCLASSIFIED

DAHC60-72-C-0053
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1 OF 1
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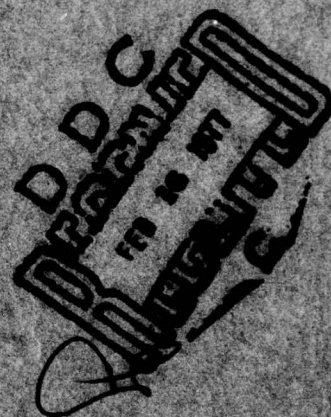


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EAGLE-PICKER INDUSTRIES, INC.



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Battery Wet Primary, BA 494 /U

6 Final
TECHNICAL REPORT
FOR
BA 494 /U
15 CONFIDENTIAL NO. DAHC60-72-C-0053
4212-T-1176
14 (FINAL)

11 12 Nov 1976

Tests Performed by:

EAGLE-PICHER INDUSTRIES, INC.
Electronics Division
Couples Department
Joplin, Missouri
Code Ident. 81855

12 30 p.
DDC
RECEIVED
NOV 16 1977

Date of Tests:
Report Written by:
Engineering Supervisor:
Test Engineer:
Test Technician:
Equipment Supervisor:
Inspector:

10 1 November 1976
D. H. Spracklen
R. E. Barnett
P. D. Cantrell
Gary Landreth
E. Donaldson
Ray Moenkhoff

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REPORT SUMMARY SHEET

1. COMPONENT PART NAME PER GENETIC CODE Battery, Wet Primary, BA 494 /U				2. PROGRAM OR WEAPON SYSTEM Safeguard				3. DAY MO. YR.							
4. ORIGINATOR'S REPORT TITLE Final Technical Report for BA 494 /U Contract No. DAHC60-72-C-0053				5. ORIGINATOR'S REPORT NO. 4212-T-1176				TEST COMPL. 1 11 76							
				6. TEST TYPE, ETC Fifty-Four (54) Month Storage				REPT COMPL. 12 11 76							
7. THIS TEST (SUPERSEDES) (SUPPLEMENTS) REPORT NO: N/A															
8. ITEM	8A PART TYPE, SIZE, RATING, LOT, ETC			9. VENDOR		10. VENDOR PART NO.		11. IND/GOV. STD. NO.		12. TOTAL TESTED					
1	Dual Section Primary Remote Ag-Zn Battery, Lot 22			Eagle-Picher Ind., Inc.		GAP 4212		N/A		2					
2	Dual Section Primary Remote Ag-Zn Battery, Lot 19			Eagle-Picher Ind., Inc.		GAP 4212		N/A		2					
3															
4															
13. INTERNAL SPECS. REQ'D TO UTILIZE RPT ENCL.				SENT WITH REPORT NO.				14. MIL. SPECS./STDS. REFERENCED IN ISC							
A LSATP-308, Lot Acceptance Test Procedures				N/A Lot Acceptance Test Report No. 1 (16 May 1972)				D N/A							
B Spec. 11425737				N/A				E N/A							
C N/A								F N/A							
15A ITEM	TEST OR ENVIRONMENT		C PER SPEC	D SPEC. PARAGRAPH/METHOD/CONDITION		E TEST LEVELS, DURATION AND OTHER DETAILS				F NO. TESTED	G ASD. FAILED				
	120°F Bench		A	Para. 8.15		Batteries had been stored at 120°F for 54 months				2					
	110°F Bench		A	Para. 8.15		Battery had been stored at 110°F for 108 months (9 years)				1	0				
	110°F Bench		A	Para. 8.15		Battery had been stored at Room Temperature for 108 months (9 yrs)				1	0				
16. SUMMARY OF REPORT, NATURE OF FAILURES AND CORRECTIVE ACTION TAKEN: This report covers the testing of two (2) randomly chosen batteries from Lot 22 which have been stored for 54 months at 120°F. The failure of some specimens to maintain 14.0 volts after ground power cut-off is discussed in this report. It also contains Discharge Data Sheets, Activation Traces, curves showing X trends for Rise Time and Capacity, and summaries This report also includes information concerning testing of two (2) batteries stored 9 years; one at room temperature and one at 110°F, along with accumulated data from Lot 19. These batteries performed well.															
17. TESTED BEYOND VENDOR CATALOG VS. SPECIFICATIONS <input type="checkbox"/>				18. VENDOR INFORMATION AS TEST RESULTS BY LETTER CY OF RPT ORAL <input type="checkbox"/>				19. SIGNED <i>[Signature]</i>				20. CONTRACTOR <i>[Signature]</i>			

21. RPT NO. 4212-T-1176

ref MIL-STD-881
28 August 1963

The title and identifying symbol number should be stipulated when requesting copies of Military Standards.

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DISCUSSION

This final report on Contract Number DAHC60-72-C-0053, which includes the report of 54-month tests, completes required coverage of the testing of BA 494 batteries manufactured as Lot 22 of the above contract. Lot 22 was the first lot built to Specification Number 11425737, and consisted of forty-six (46) batteries; Serial Numbers 00664E0772 through 00709E0372. Disposition of the samples is as follows:

Fifteen (15) batteries were delivered to SAFSCOM, two of which were returned to Eagle-Picher for destruct testing at eighteen months (See Summary in Appendix I); Six (6) were destruct lot acceptance tests; twenty-five (25) samples were stored at 120°F for a four and one-half (4 1/2) year storage program, eighteen of which were to have been tested at the rate of two every six months. One extra was tested at eighteen months, leaving six (6) undesignated samples, suggested disposition of which will be discussed later.

Most of the fabrication of this lot occurred between 24 February and 23 March 1972. Pre-pilot tests were conducted 27 February through 29 February 1972, block tests from 7 March through 21 March 1972. Fabrication was completed by 31 March 1972 with final inspection and random selection of test samples finished by 23 April 1972. Final Inspection Summary is in Appendix I.

Lot Acceptance Testing was accomplished on 4 and 5 May 1972, and was covered in the Lot Acceptance Test Report dated 16 May 1972. Information from these tests is included in Destructive Test Summary in Appendix I.

The following reports, dated as shown, covered the delayed testing, with data also being used in the Summary in Appendix I.

Storage Report No. 1	(4212-S172)	6 NOV 1972
Storage Report No. 2	(4212-S273)	7 MAY 1973
Storage Report No. 3	(4212-S373)	29 OCT 1973
Storage Report No. 4	(4212-S474)	8 APR 1974
Storage Report No. 5	(4212-S-1074)	9 OCT 1974
Storage Report No. 6	(4212-S-0475)	9 MAY 1975
Storage Report No. 7	(4212-S-1075)	1 OCT 1975
Storage Report No. 8	(4212-S-0476)	14 APR 1975

Reports 1, 3, 5 and 7 also included delayed test data for Lot 19 batteries stored and tested at 110°F. This report includes the 108-month testing of two (2) Lot 19 samples, one of which had been stored at room temperature, but was tested at 110°F. Summary of these and previous Lot 19 batteries is presented in Appendix II.

Appendix I also includes a print-out of latest tests for Lot 22 as well as a print-out of all Lot 22 120°F storage tests, curves of \bar{X} trends for rise time and capacity for Lot 22 batteries, distribution curves for Lot 22, and the discharge data sheets along with the activation traces.

Appendix II, along with the summary, offers \bar{X} trend curves for Lot 19 nine-year storage program for rise time and capacity. Also included in Appendix II are the discharge data sheets and the activation traces for the two Lot 19 batteries.

The data presented herein demonstrates the adequacy of the BA 494/U after exposure to 4.5 years at 120°F and after 9 years at 110°F.

One battery stored nine years at room temperature showed no loss in capacity and no change in activation time when activated at 110°F.

There are two parameters which are adversely affected by the 120°F storage. The first was after thirty months; the reverse current (additional demand on ground power) on one test sample was 9.5 amperes. Previously the maximum noted was 5 amperes.

The second was after thirty-six months; the minimum voltage after ground-power cutoff (spec. 14.0 V. min) was 13.3 volts on one test unit.

These two parameters are not necessarily associated with one another. As a matter of fact, a study of the data presented in Table 1 indicates that none of the units with low voltage after ground-power cutoff had a high reverse current or vice versa.

It is noted that all but one of the units which had a rise time in excess of 120 ms also had low voltage after ground-power cutoff. The longest rise time to date was 179 ms which is still within tolerance.

There were four (4) units which were below the 14.0 VDC minimum after ground-power cutoff. The lowest was 9.8 volts which also required the longest rise time (179 ms) after 54 months.

Since this is really the only out-of-tolerance condition noted during the storage tests, Eagle-Picher recommends consideration be given to re-evaluate the 14.0 volt requirement. The data to date demonstrates that even when the voltage was only 9.8 volts at 105 ms, the battery still activated well below the 200 ms requirement.

TABLE I

STORAGE TIME AT 120°F IN MONTHS	MINIMUM VOLTAGE AFTER GROUND POWER CUTOFF				PEAK VOLTAGE		REVERSE CURRENT	
	POSITIVE		NEGATIVE		POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
	VOLTS	RISE TIME	VOLTS	RISE TIME				
6	18.9		18.8		18.9	18.8	1.5	1.5
12	18.9		18.7		18.9	18.9	2.0	2.0
12	18.4		18.7		18.9	18.9	4.0	5.0
18	17.4		18.8		18.6	18.9	2.0	1.5
18	18.6		18.6		18.9	18.9	4.0	2.5
18	18.5		18.9		19.0	19.0	2.0	2.0
24	18.4		18.8		18.9	18.9	2.6	1.6
24	17.6		18.0		19.0	19.0	2.0	4.0
30	17.2		18.25		19.0	18.9	9.5	3.0
30	18.8		17.4		19.1	19.1	4.0	13.0
36	18.3	82 ms	13.3	150 ms	19.0	19.0	6.0	2.0
36	18.3		18.9		19.1	19.2	2.0	1.5
42	17.0		17.1		19.0	19.0	16.0	9.0
42	18.1		17.8		19.0	19.0	8.6	7.5
48	18.8	79 ms	18.6	80 ms	19.1	19.1	8.6	9.0
48	14.13	122 ms	15.78	148 ms	19.0	19.0	7.8	3.4
54	12.1	170 ms	18.4	88 ms	19.0	18.9	3.2	6.0
54	15.5	155 ms	9.8	179 ms	18.7	19.1	16.5	1.75

Although the present report is the final report for Contract DAHC60-72-C-0053, Eagle-Picher proposes to continue storing the remaining six (6) batteries at 120°F, testing one unit every six months. There is one more unit remaining at 110°F which will be tested next year. This will give data out to ten years at 110°F and 7.5 years at 120°F.

Eagle-Picher will transmit the data generated by this extension of testing as supplements to the present final report.

APPENDIX I

BA 400 (HU) (CAP 4212)

CONTRACT NO. DARC60-72-C-0015										FINAL INSPECTION (Non-Destruct)			SPECIFICATION NO 114-25737		
LOT NO	SERIAL NO	WORK MARKSHIP	LABELS	DATE	WEIGHT (LBS)	GENERATOR RESISTANCE (ohms)	INSULATION RESISTANCE (100 megohms)	DELECTOR STRENGTH (psi) (100 psi min)	LEAKS CHECK	TEST	TEST	TEST	TEST	TEST	
22 (S/N 0066-4E0372 THROUGH S/N 00709E0372)															
(LOT SAMPLES)															
4-10-72	00669E0372	OK	OK	OK	5.92	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00676E0372	OK	OK	OK	5.95	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00683E0372	OK	OK	OK	5.94	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00690E0372	OK	OK	OK	5.93	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00702E0372	OK	OK	OK	5.94	1.00	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00707E0372	OK	OK	OK	5.94	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
(STORAGE SAMPLES)															
4-10-72	00665E0372	OK	OK	OK	5.89	1.03	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00667E0372	OK	OK	OK	5.92	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00670E0372	OK	OK	OK	5.90	1.04	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00671E0372	OK	OK	OK	5.93	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00673E0372	OK	OK	OK	5.88	1.07	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00674E0372	OK	OK	OK	5.94	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00675E0372	OK	OK	OK	5.93	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00677E0372	OK	OK	OK	5.94	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00679E0372	OK	OK	OK	5.95	1.03	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00680E0372	OK	OK	OK	5.94	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00681E0372	OK	OK	OK	5.94	1.05	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00684E0372	OK	OK	OK	5.94	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00685E0372	OK	OK	OK	5.93	1.05	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00687E0372	OK	OK	OK	5.93	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00689E0372	OK	OK	OK	5.94	1.04	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00690E0372	OK	OK	OK	5.93	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00693E0372	OK	OK	OK	5.94	1.04	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00694E0372	OK	OK	OK	5.95	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00695E0372	OK	OK	OK	5.95	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00697E0372	OK	OK	OK	5.95	1.02	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00700E0372	OK	OK	OK	5.95	1.03	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00703E0372	OK	OK	OK	5.91	1.00	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00704E0372	OK	OK	OK	5.94	1.05	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-10-72	00705E0372	OK	OK	OK	5.94	1.01	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	
4-21-72	00708E0372	OK	OK	OK	5.94	1.06	OK	OK	OK	CLOSED	OK	CLOSED	OK	24 MO	

* STILL STORED AT 12.0°F

TABLE II

RISE TIME SPEC 200 MSEC MAXIMUM
 RAW DATA LISTING
 170.0000 88.0000 115.0000 179.0000

SAMPLE MEAN = 138.0000
 SAMPLE SIZE = 4
 STANDARD DEVIATION = 43.718799
 $K((AVG-REQ)/SIG) = 1.4182$
 $3.*SIG = 131.1564$
 $3.07*SIG = 134.2167$
 REQ = 200.000
 $MEAN+3.07*SIG = 272.2167, MEAN-3.07*SIG = 3.7833$
 $MEAN+3.*SIG = 269.1564, MEAN-3.*SIG = 6.8436$
 SUM X = 552.00000
 SUM XSQR = 81980.00006

CAPACITY SPEC 57 SECONDS MIN
 RAW DATA LISTING
 110.0000 97.0000 115.0000 128.0000

SAMPLE MEAN = 112.5000
 SAMPLE SIZE = 4
 STANDARD DEVIATION = 12.819256
 $K((AVG-REQ)/SIG) = 4.3294$
 $3.*SIG = 38.4578$
 $2.07*SIG = 39.3551$
 REQ = 57.000
 $MEAN+3.07*SIG = 151.8551, MEAN-3.07*SIG = 73.1449$
 $MEAN+3.*SIG = 150.9578, MEAN-3.*SIG = 74.0422$
 SUM X = 450.00000
 SUM XSQR = 51118.00003

Above is a copy of the computer printout of current Lot 22 Delayed Test.

This information was used in preparation of pages 15 through 18.

TABLE III

RISE TIME SPEC 200 MSEC MAXIMUM
RAW DATA LISTING

79.0000	87.0000	90.0000	84.0000	75.0000	70.0000	76.0000
74.0000	80.0000	71.0000	87.0000	84.0000	78.0000	95.0000
95.0000	80.0000	82.0000	150.0000	63.0000	67.0000	104.0000
101.0000	86.0000	86.0000	148.0000	122.0000	80.0000	79.0000
170.0000	88.0000	115.0000	179.0000			

SAMPLE MEAN = 94.5313
 SAMPLE SIZE = 32
 STANDARD DEVIATION = 29.080516
 $K((AVG-REQ)/SIG) = 3.6268$
 $3.*SIG = 87.2415$
 $3.07*SIG = 89.2772$
 REQ = 200.000
 $MEAN+3.07*SIG = 183.8084$, $MEAN-3.07*SIG = 5.2541$
 $MEAN+3.*SIG = 181.7728$, $MEAN-3.*SIG = 7.2897$
 SUM X = 3025.00000
 SUM XSQR = 312173.00036

CAPACITY SPEC 57 SECONDS MINIMUM
RAW DATA LISTING

184.0000	178.0000	150.0000	150.0000	136.0000	150.0000	140.0000
136.0000	171.0000	176.0000	132.0000	133.0000	143.0000	118.0000
124.0000	122.0000	104.0000	111.0000	150.0000	150.0000	138.0000
140.0000	153.0000	75.0000	122.0000	111.0000	154.0000	154.0000
110.0000	97.0000	115.0000	128.0000			

SAMPLE MEAN = 136.0938
 SAMPLE SIZE = 32
 STANDARD DEVIATION = 24.413586
 $K((AVG-REQ)/SIG) = 3.2397$
 $3.*SIG = 73.2408$
 $3.07*SIG = 74.9497$
 REQ = 57.000
 $MEAN+3.07*SIG = 211.0435$, $MEAN-3.07*SIG = 61.1440$
 $MEAN+3.*SIG = 209.3345$, $MEAN-3.*SIG = 62.8530$
 SUM X = 4355.00000
 SUM XSQR = 611165.00073

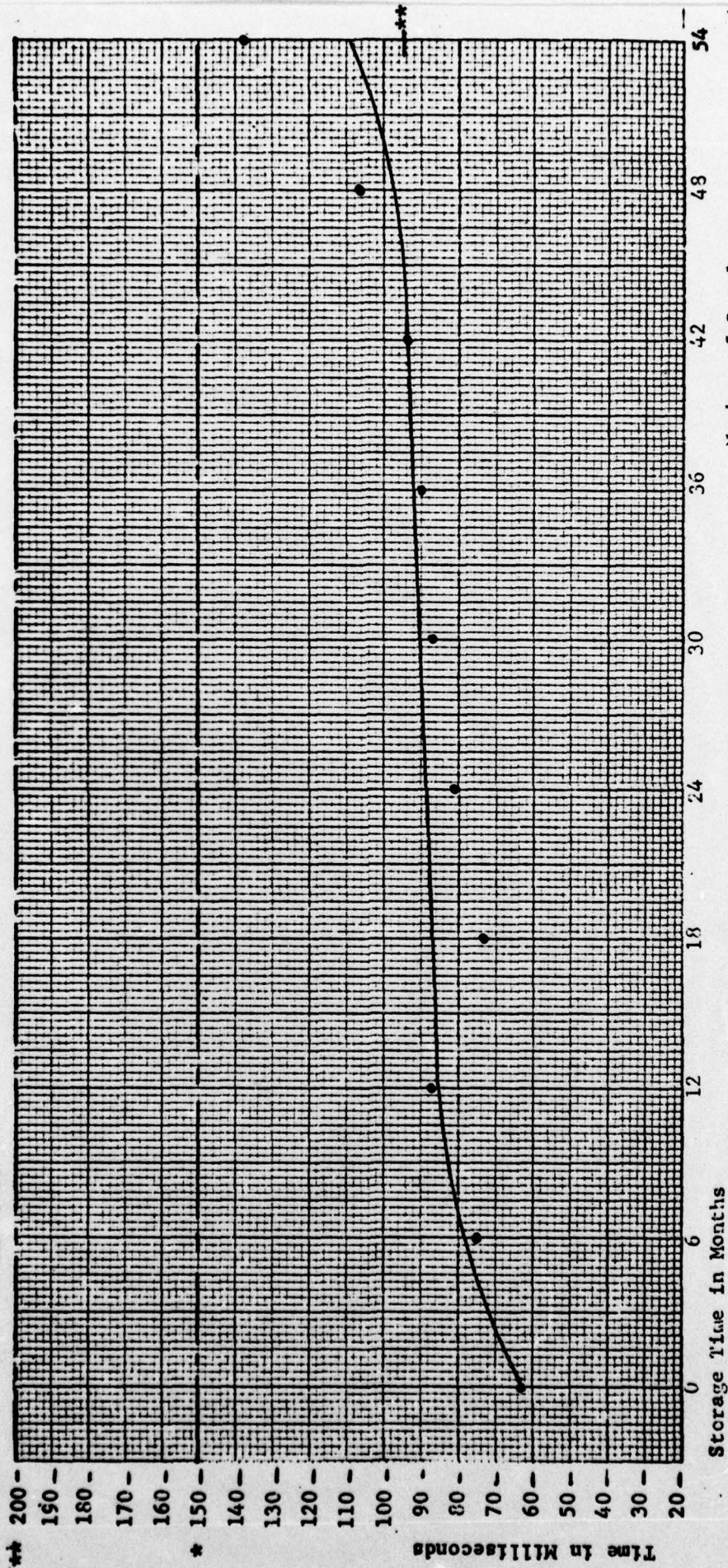
Above is a copy of the computer printout of 12 month or longer storage at
 120°F of Lot 22 Batteries. This information used in preparation of pages
 15 through 18.

Batteries Stored and Tested at 120°F.

Specification: * 150 ms max for New and 6 month batteries

** 200 ms max for 12 month and over

• = \bar{X}
— = \bar{X} Trend



Storage Time in Months

Number of Samples:

New	14	30 month	4
6 month	2	36 month	4
12 month	10	42 month	4
18 month	4	48 month	4
24 month	4	54 month	4

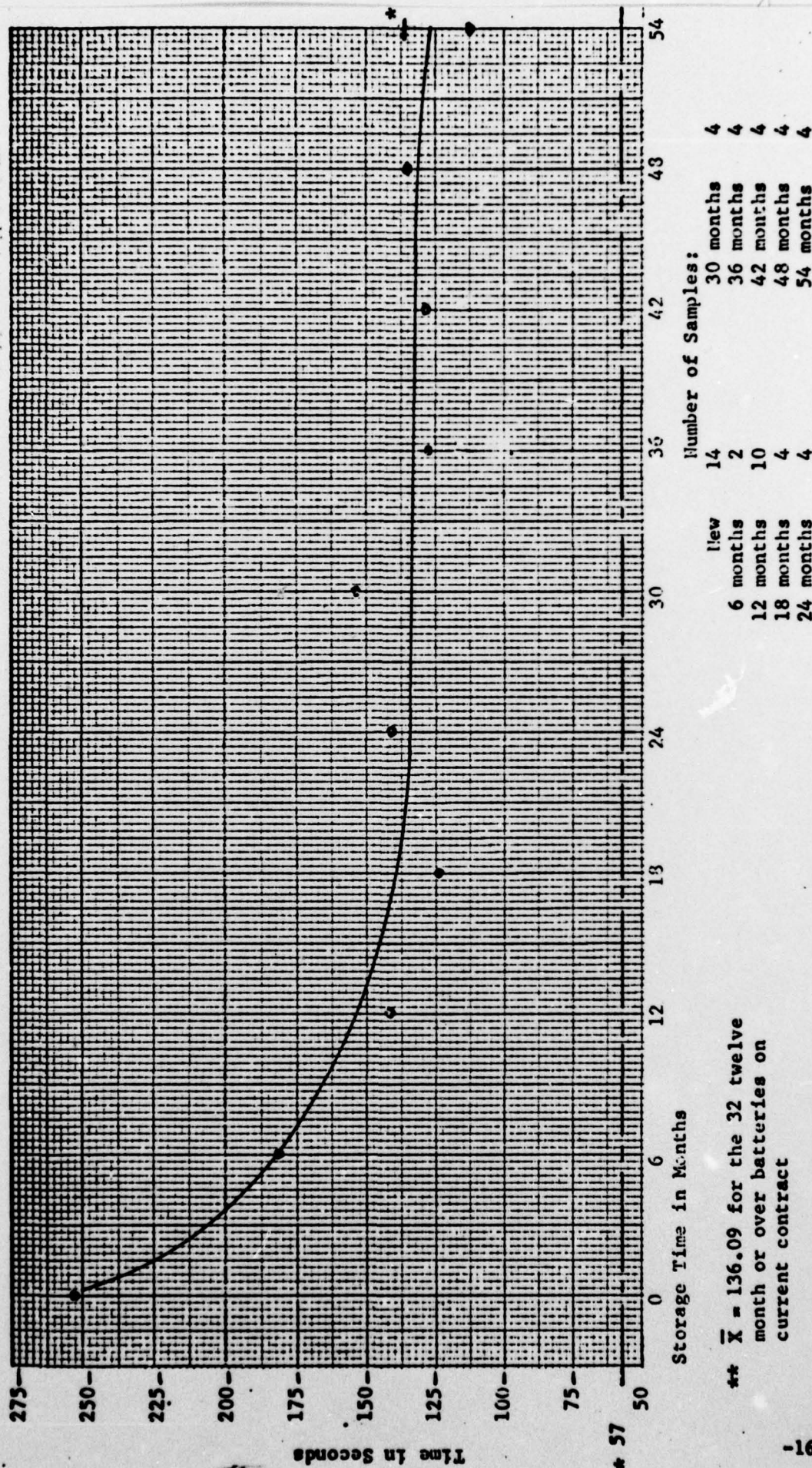
*** $\bar{X} = 94.53$ for the 32 twelve month or over batteries on the current contract

RISE TIME

Batteries Stored And Tested at +120°F.

Specification: 57 seconds minimum *

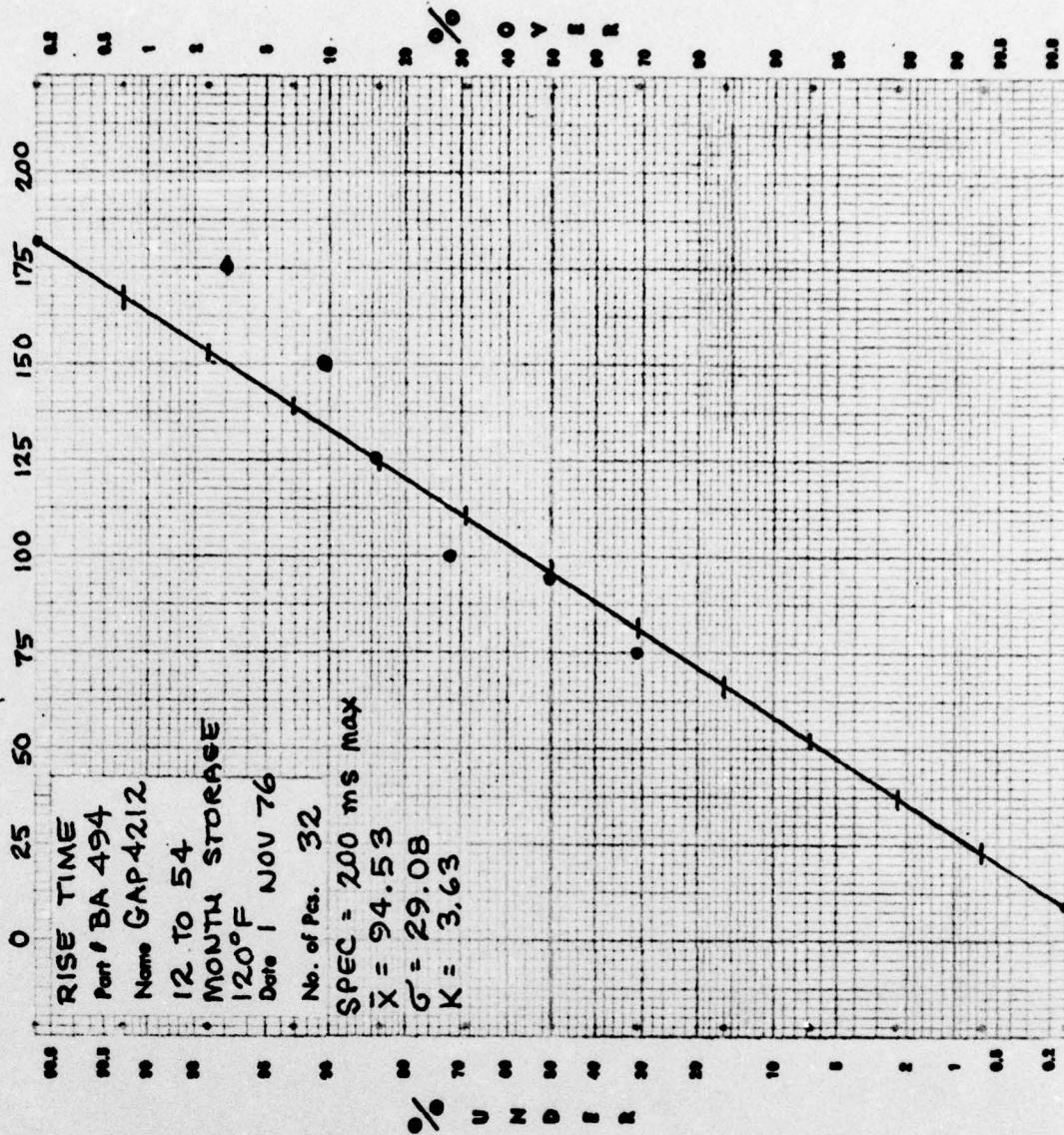
• \bar{X}
 — \bar{X} Trend



** \bar{X} = 136.09 for the 32 twelve month or over batteries on current contract

CAPACITY

for Construction of Distribution Curve

[illegible]

Battery Type BA 494/UType Test PENCHTime Fired 1105Position LAUNCHFirst Volt Ind. + 12 msRise Time (16.63) + 170 msMax. Volts + 19.03Time to Max. V. + 370 msLife to 16.63V + 110 secGround Power Off + 100 msMax Reverse Current + 3.2 ampSpecimen No. 4 1/2 YEAR, 120°FLot No. 22

STORAGE

S/N 00671E0372Date 1 NOVEMBER 1976Temp. 120°FFirst Volt In. - 6 msRise Time (16.63) - 82 msMax. Volts - 18.93Time to Max. V - 370 msLife to 16.63 V - 97 secGround Power off - 103 msMax Reverse Current - 6 amp

POSITIVE SECTION

Time	Min. Volts	Max. Volts	Min. Amps	Max. Amps
105 ms	12.1	12.16	7.6	
150 ms		14.72	9.2	
350 ms	16.2	18.84	11.8	
370 ms	18.62	19.03	5.5	17.5
2 sec.	18.26	18.70	5.45	17.4
4 sec.	18.12	18.58	5.4	17.2
9.8 sec.	17.9	18.34	5.3	16.8
10 sec.	18.0	18.29	6.4	14.2
30 sec.	17.77	18.10	6.3	14.0
50 sec.	17.68	18.00	6.25	14.0
57 sec.	17.65	17.98	6.2	14.0
97 sec.	17.17	17.50	6.0	13.5
100 sec.	16.98	17.30	6.0	13.5
110 sec.	16.63	16.95	6.0	13.2
200 sec.				
250 sec.				
300 sec.				
350 sec.				

NEGATIVE SECTION

Min. Volts	Max. Volts	Min. Amps	Max. Amps
	18.40	11.4	
	18.84	11.8	
	18.72	11.8	
18.51	18.93	5.5	17.5
18.17	18.67	5.4	17.1
18.09	18.53	5.4	17.0
17.86	18.31	5.3	17.0
17.97	18.18	6.4	14.2
17.72	18.08	6.3	14.0
17.62	17.98	6.25	14.0
17.59	17.92	6.25	13.9
16.63	16.95	6.0	13.0

Battery Type BA 494/UType Test BENCHTime Fired 1155Position LAUNCHFirst Volt Ind. + 11 msRise Time (16.63) + 115 msMax. Volts + 18.65Time to Max. V. + 370 msLife to 16.63V + 115 secGround Power Off + 101 msReverse Current 16.5Specimen No. 4 1/2 YEAR, 120°FLot. No. 22

STORAGE

S/N 00680E0372Date 1 NOVEMBER 76Temp. 120°FFirst Volt In. - 15 msRise Time (16.63) - 179 msMax. Volts - 19.10Time to Max. V - 370 msLife to 16.63 V - 128 secGround Power off - 105 msReverse Current - 1.75

POSITIVE SECTION

Time	Min. Volts	Max. Volts	Min. Amps	Max. Amps
105 ms	15.52	15.52	9.7	
150 ms		18.30	11.6	
350 ms		18.32	11.7	
370 ms	18.12	18.65	5.4	17.1
2 sec.	18.03	18.55	5.3	17.0
4 sec.	17.71	18.42	5.25	16.9
9.8 sec.	17.72	18.23	5.25	16.7
10 sec.	17.83	18.18	6.4	14.1
30 sec.	17.66	18.00	6.3	14.0
50 sec.	17.60	17.93	6.25	14.0
57 sec.	17.58	17.91	6.25	13.9
100 sec.	17.17	17.50	6.10	13.6
115 sec.	16.63	17.00	5.9	13.0
128 sec.				
200 sec.				
250 sec.				
300 sec.				
350 sec.				

NEGATIVE SECTION

Min. Volts	Max. Volts	Min. Amps	Max. Amps
9.76	9.76	6.1	
	14.72	9.2	
	18.87	11.7	
18.60	19.10	5.6	17.7
18.17	18.69	5.4	17.4
18.02	18.57	5.4	17.2
17.81	18.32	5.3	16.7
17.92	18.28	6.4	14.2
17.71	18.08	6.3	14.0
17.65	18.00	6.25	14.0
17.62	17.98	6.25	13.9
17.39	17.74	6.2	13.7
17.19	17.50	6.1	13.5
16.63	17.00	5.9	13.0



S/N 0068060372
LOT 22

APPENDIX II

CONTRACT NO. DAAB07-67-C-0313

BA 494 (1/U)

CAP 4212 (LOT 19)

				RISE TIME (min.)		G.P. CUTOFF (min.)		LOW VOLTAGE CUTOFF (min.)		POSITIVE (19.25 MA.)		NEGATIVE (19.25 MA.)		VOLTS AT 112 MS		VOLTS AT 150 MS		VOLTS AT 2 SECS		VOLTS AT 8 SECS	
TEST DATE	SERIAL NUMBER	TYPE TEST	STORAGE TEMP.	TEST TEMP.	POS.	NEG.	POS.	NEG.	POS.	NEG.	PEAK VOLTS	RATE	PEAK VOLTS	RATE	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.
LOT 19 (LOT ACCEPTANCE TEST RESULTS)																					
9-6-67	00581E0867	ACCEL	N/A	120°	67	60	110	110	N/A	N/A	18.80	15.0	150	18.74	5.3	360	18.75	18.68	18.80	18.67	18.04
9-6-67	00520E0867	ACCEL	N/A	120°	67	60	110	110	N/A	N/A	19.18	15.4	112	19.23	15.5	360	19.18	19.20	19.14	19.15	18.62
9-6-67	00548E0867	ACCEL	N/A	110°	72	74	110	110	N/A	N/A	18.81	7.5	360	18.95	5.5	360	18.70	18.70	18.78	18.82	18.09
9-6-67	00540E0867	ACCEL	N/A	110°	68	75	110	110	N/A	N/A	19.20	7.7	360	19.20	5.6	360	19.15	19.17	19.18	19.19	18.70
9-6-67	00514E0867	ACCEL	N/A	110°	72	70	110	110	N/A	N/A	19.10	7.7	360	19.12	5.5	360	19.05	18.94	19.05	19.08	18.48
9-6-67	00512E0867	SACCH	N/A	110°	73	78	110	110	N/A	N/A	19.15	7.7	360	19.22	5.5	360	18.92	18.63	19.11	19.10	18.46
9-6-67	00587E0867	CHUCK	N/A	110°	67	63	110	110	N/A	N/A	18.81	7.5	360	18.78	5.3	360	18.64	18.75	18.70	18.76	18.09
9-6-67	00515E0867	VIB	N/A	120°	62	72	110	110	N/A	N/A	19.20	7.2	360	19.20	5.5	360	19.12	19.10	19.16	19.10	18.60
9-6-67	00544E0867	VIB	N/A	120°	68	61	110	110	N/A	N/A	19.19	7.7	360	19.21	5.6	360	19.15	19.18	19.15	19.17	18.75
9-6-67	00513E0867	VIB	N/A	120°	62	64	110	110	N/A	N/A	19.22	13.8	112	19.23	5.6	360	19.22	19.20	19.19	19.20	18.39
LOT 19 (12 MONTH STORAGE BATTERIES)																					
10-8-68	00537E0867	BENCH	110°	110°	119	100	102	103	16.20	16.75	19.24	7.7	360	19.23	5.6	360	18.60	17.20	18.00	18.85	19.00
10-8-68	00541E0867	BENCH	120°	125°	83	68	100	100	N/A	N/A	19.20	7.8	360	19.24	5.7	360	18.78	17.10	19.46	19.41	18.22
10-8-68	00540E0867	BENCH	120°	120°	90	92	101	101	N/A	N/A	19.23	7.75	360	19.23	5.6	360	18.45	18.28	19.10	19.06	18.45
10-8-68	00545E0867	BENCH	110°	110°	110	110	100	100	16.40	16.93	19.23	7.75	360	19.25	5.6	360	17.35	17.20	18.85	18.93	18.40
10-8-68	00547E0867	BENCH	120°	120°	85	80	100	100	N/A	N/A	19.24	15.4	160	19.45	15.6	360	18.43	18.20	19.21	19.21	18.43
10-8-68	00549E0867	BENCH	110°	110°	100	101	100	100	16.95	16.50	19.20	7.7	360	19.20	5.6	360	17.85	18.65	19.00	18.65	18.64
10-8-68	00521E0867	BENCH	120°	125°	89	92	100	100	N/A	N/A	19.23	7.7	360	19.23	5.6	360	18.40	18.20	19.12	19.02	18.41
LOT 19 (8 MONTH STORAGE BATTERIES)																					
4-1-69	00521E0867	BENCH	110°	110°	113	125	96	96	16.23	15.58	19.49	7.4	360	19.18	7.4	360	17.6	17.05	18.22	17.7	18.22
4-1-69	00547E0867	BENCH	110°	110°	100	112	100	100	16.85	16.31	19.39	7.4	360	19.25	7.4	360	17.25	17.05	18.29	17.71	18.45
4-1-69	00534E0867	BENCH	110°	100°	151	128	102	101	15.05	15.61	19.43	7.4	360	19.31	7.4	360	17.20	17.25	18.41	17.72	18.57
4-1-69	00535E0867	BENCH	110°	100°	147	126	101	100	15.28	15.55	19.31	7.4	360	19.27	7.4	360	17.25	17.21	18.40	17.83	18.61
E THREE TIMES WERE OBTAINED BY TAKING 9/13 OF THE NEGATIVE CAPACITY TO MAKE THE DATA COMPARABLE WITH THE POSITIVE DATA SECTION RATE AND TWELVE (6) IS APPROXIMATELY THE POSITIVE SECTION RATE IN AMPHOURS.																					
F THE POSITIVE AND NEGATIVE SECTIONS ARE NOW DISCHARGED AT THE SAME RATE ELIMINATING THE NEED FOR CHANGE.																					
LOT 19 (24 MONTH STORAGE BATTERIES)																					
10-1-69	00546E0867	BENCH	110°	110°	108	111	95	94	16.45	16.32	19.88	15.50	360	19.00	15.25	360	16.05	16.70	18.25	18.00	18.85
10-1-69	00586E0867	BENCH	110°	110°	107	100	100	100	16.51	16.82	19.18	15.35	360	19.25	15.05	360	17.03	17.41	18.00	18.55	18.32
LOT 19 (30 MONTH STORAGE BATTERIES)																					
4-2-70	00513E0867	BENCH	110°	110°	104	95	92	90	16.37	16.50	19.63	7.7	360	19.62	7.8	360	17.85	17.48	18.82	18.84	19.81
4-2-70	00516E0867	BENCH	110°	110°	125	112	95	93	15.35	16.05	19.16	7.7	360	18.97	7.6	360	15.32	16.63	17.80	18.26	18.60
LOT 19 (42 MONTH STORAGE BATTERIES)																					
4-7-71	00524E0867	BENCH	110°	110°	99	92	92	91	16.30	17.40	19.45	7.8	360	19.50	7.75	360	17.66	18.05	18.81	18.41	18.37
4-7-71	00548E0867	BENCH	110°	110°	110	90	90	90	16.13	17.25	19.54	7.8	360	19.60	7.75	360	16.46	18.15	18.45	18.45	19.00
LOT 19 (48 MONTH STORAGE BATTERIES)																					
10-7-71	00574E0867	BENCH	110°	110°	97	87	96	96	16.45	17.45	19.28	7.8	360	19.12	8.3	360	17.80	18.20	18.95	18.95	18.63
LOT 19 (60 MONTH STORAGE BATTERIES)																					
10-11-72	00535E0867	BENCH	110°	110°	84	74	93	93	17.19	17.6	19.56	8.5	370	19.90	8.5	370	18.45	18.18	19.17	19.05	19.10
LOT 19 (72 MONTH STORAGE BATTERIES)																					
10-5-73	00523E0867	BENCH	110°	110°	90	80	100	102	17.4	18.0	19.85	8.8	370	19.60	8.6	370	17.90	18.33	19.08	19.20	19.18
LOT 19 (84 MONTH STORAGE BATTERY)																					
10-2-74	00517E0867	BENCH	110°	110°	83	68	102	104	17.82	18.1	19.68	8.6	360	19.63	8.6	360	18.4	18.6	19.28	19.31	19.08
LOT 19 (96 MONTH STORAGE BATTERY)																					
3-19-75	00579E0867	BENCH	110°	110°	82	85	98	95	16.75	17.12	19.33	8.7	360	19.26	8.4	360	17.41	17.55	18.6	18.55	18.78
LOT 19 (108 MONTH STORAGE BATTERIES)																					
11-1-76	00514E0867	BENCH	110°	110°	92	83	103	105	17.32	17.60	19.66	8.7	370	19.84	8.7	370	17.67	18.21	19.19	19.10	19.28
11-1-76	00566E0867	BENCH	72°	110°	81	63	103	105	18.10	18.10	19.19	8.5	370	19.35	8.6	370	18.76	18.52	19.05	19.13	18.40

C-0313

BA 494 (1/10)

CAP 4212 (LOT 19)

SCL-7773-D

TIME P. (HRS)		G.P. CUTOFF (MA)		LOW VOLTAGE G.P. CUTOFF		POSITIVE (19.25 MA)		NEGATIVE (19.25 MA)		VOLTS AT 112 MS		VOLTS AT 150 MS		VOLTS AT 2 SECS		VOLTS AT 8 SECS		VOLTS AT 10 SECS		VOLTS AT 30 SECS.				LIFE (SECS)		57
POS.	NEG.	POS.	NEG.	POS.	NEG.	PEAK VOLTS	RATE	PEAK VOLTS	RATE	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.	NEG.	POS.	NEG.	

AGE BATTERIES

113	100	102	102	16.20	16.75	19.24	7.7	360	19.23	5.6	360	18.60	17.20	18.90	18.85	19.00	19.00	18.10	18.15	18.00	18.05	17.40	17.82	17.53	17.88	112	155	123
81	68	100	100	N/A	N/A	19.40	7.8	360	19.54	5.7	360	18.78	19.10	19.46	19.41	18.92	19.00	18.22	18.30	18.15	18.22	17.60	17.90	17.79	18.25	100	104	90
90	92	101	101	N/A	N/A	19.23	7.75	360	19.23	5.6	360	18.45	18.28	19.10	19.06	18.45	18.57	17.97	18.05	17.93	18.02	17.51	17.60	17.64	17.98	132	160	124
110	110	100	100	16.90	16.90	19.23	7.75	360	19.25	5.6	360	17.35	17.60	18.85	18.93	18.45	18.54	17.94	17.98	17.90	17.95	17.45	17.60	17.60	17.92	150	170	141
85	80	100	100	N/A	N/A	19.24	15.4	160	19.45	5.6	360	18.43	19.20	19.21	19.21	18.63	18.13	18.05	18.30	18.01	18.22	17.55	17.90	17.73	18.05	117	154	119
100	101	100	100	16.95	16.95	19.20	7.7	360	19.20	5.6	360	17.85	18.85	19.00	18.65	18.64	18.65	18.09	18.21	18.03	18.09	17.43	17.85	17.63	17.95	111	151	118
89	92	100	100	N/A	N/A	19.23	7.7	360	19.23	5.6	360	18.40	18.50	19.12	19.09	18.41	18.65	18.09	18.20	18.05	18.15	17.57	17.93	17.74	18.00	102	142	142

AGE BATTERIES

113	125	96	96	16.23	15.58	19.49	7.4	360	19.41	7.4	360	18.40	18.85	18.92	17.7	18.22	18.15	18.10	18.15	17.98	17.90	17.43	17.89	17.41	17.8	125	110	X
100	112	100	100	16.85	16.31	19.49	7.4	360	19.41	7.4	360	18.40	18.85	18.92	17.7	18.22	18.15	18.10	18.15	17.98	17.90	17.43	17.89	17.41	17.8	125	110	X
101	126	102	101	16.05	15.61	19.43	7.4	360	19.41	7.4	360	18.40	18.85	18.92	17.7	18.22	18.15	18.10	18.15	17.98	17.90	17.43	17.89	17.41	17.8	125	110	X
107	126	101	101	16.24	15.65	19.43	7.4	360	19.41	7.4	360	18.40	18.85	18.92	17.7	18.22	18.15	18.10	18.15	17.98	17.90	17.43	17.89	17.41	17.8	125	110	X

ED BY TAKING 1/2 OF THE NEGATIVE CAPACITY TO MAKE THE DATA COMPARABLE WITH THE POSITIVE CAPACITY. NINE (9) IS APPROXIMATELY THE NEGATIVE CAPACITY IS APPROXIMATELY THE POSITIVE SECTION RATE IN AMPERES.

IVE SECTIONS ARE NOW DISCHARGED AT THE SAME RATE ELIMINATING THE NEED FOR CHANGE.

AGE BATTERIES

108	111	95	94	16.45	16.32	19.58	15.50	360	19.50	15.35	360	18.05	16.78	18.25	18.50	18.85	18.85	18.10	18.08	18.02	18.00	17.40	17.82	17.45	17.85	114	100	
107	100	100	100	16.51	16.02	19.16	15.35	360	19.25	15.05	360	18.02	17.41	18.08	18.85	18.29	18.92	17.95	17.95	17.92	17.90	17.40	17.88	17.46	17.85	145	145	142

AGE BATTERIES

104	95	92	90	16.37	16.59	19.63	7.7	360	19.63	7.8	360	17.85	17.48	18.82	18.86	19.82	19.80	18.10	18.15	17.98	17.97	17.41	17.84	17.40	17.81	112	116	
125	112	95	93	16.35	16.05	19.16	7.7	360	18.97	7.6	360	18.32	16.43	17.88	18.20	18.66	17.98	17.95	17.87	17.92	17.63	17.45	17.87	17.42	17.84	136	135	

AGE BATTERIES

99	92	92	91	16.30	17.10	19.45	7.8	360	19.50	7.75	360	17.66	18.45	18.81	18.41	18.37	19.00	18.18	18.18	18.06	18.06	17.42	17.86	17.42	17.85	94	84	
110	90	90	90	16.12	17.35	19.14	7.8	360	19.60	7.75	360	16.61	18.16	18.45	18.45	19.00	19.08	18.10	18.18	17.92	18.02	17.47	17.88	17.48	17.90	97	89	

AGE BATTERIES

97	87	96	96	16.63	17.10	19.28	7.8	360	19.22	8.3	360	17.80	18.10	18.95	18.95	18.63	18.61	18.03	18.08	17.98	18.00	17.47	17.87	17.54	17.91	132	140	
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AGE BATTERIES

81	74	95	95	17.15	17.6	19.56	5.5	370	19.50	5.5	370	18.55	18.18	19.77	19.05	17.10	19.13	18.34	18.32	18.30	18.18	17.60	17.93	17.59	17.90	123	113	
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AGE BATTERIES

90	80	100	102	17.4	18.0	19.55	5.5	370	19.60	5.4	370	17.90	18.33	19.08	19.20	19.18	19.30	18.38	18.49	18.31	18.29	17.60	17.92	17.63	17.98	109	131	
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AGE BATTERIES

83	68	102	104	17.82	18.1	19.68	5.6	360	19.63	5.6	360	18.4	18.6	19.28	19.31	19.08	17.10	18.35	18.43	18.25	18.3	17.66	17.97	17.71	18.01	110	118	
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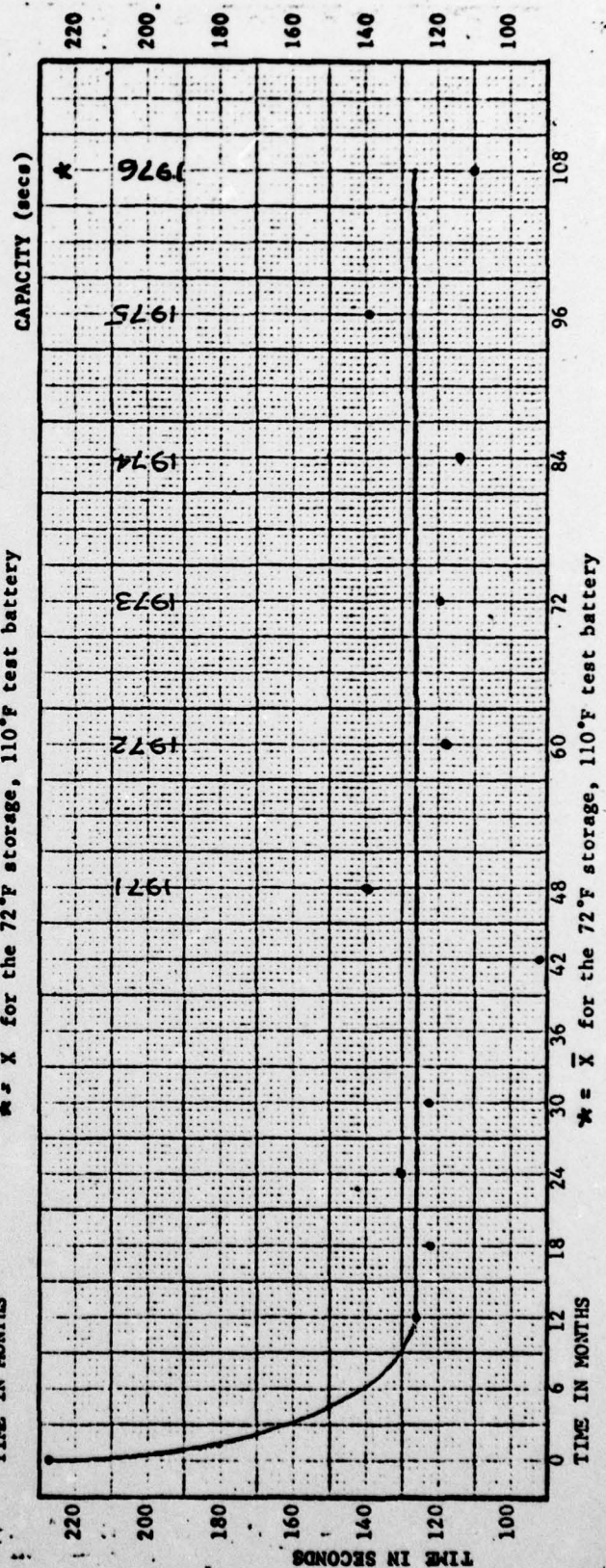
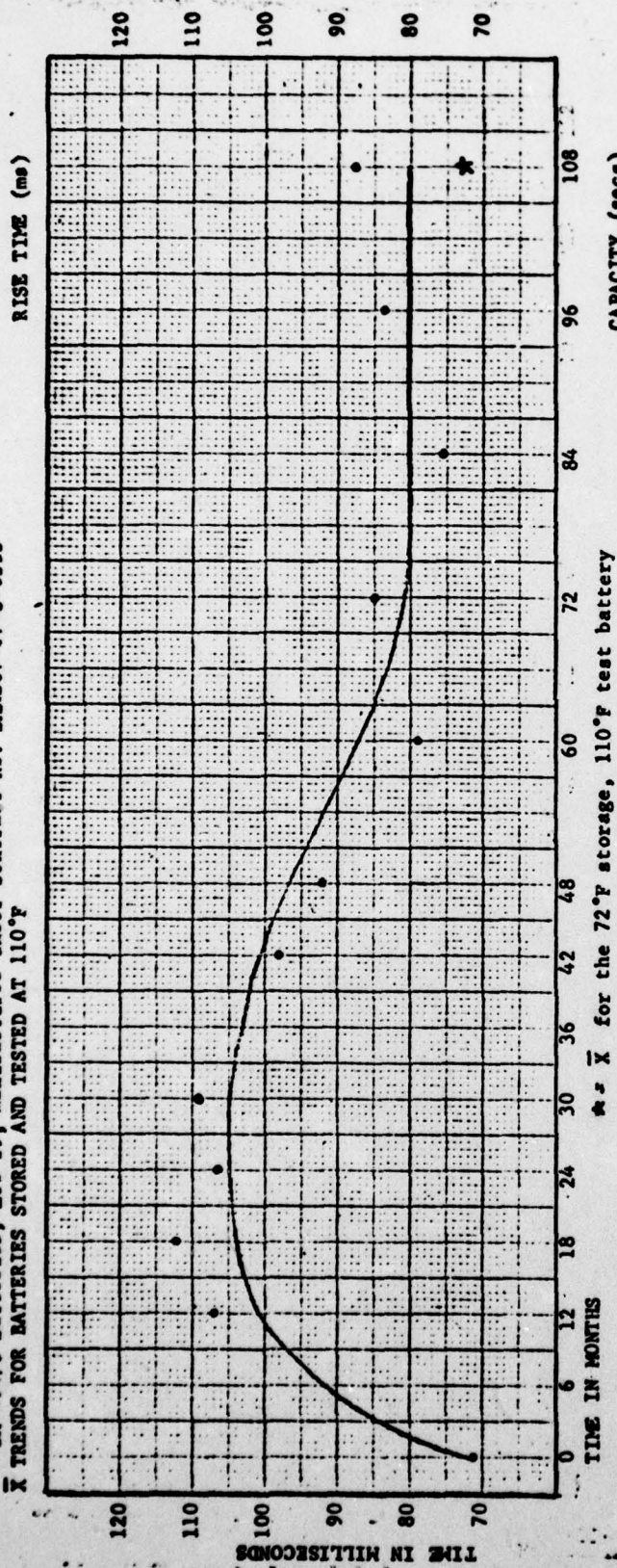
AGE BATTERIES

82	85	96	95	16.75	17.12	19.35	5.7	360	19.20	5.4	360	17.41	17.66	18.6	18.65	18.72	18.82	18.09	18.12	17.92	17.92	17.53	17.89	17.51	17.85	137	141	
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AGE BATTERIES

92	83	103	105	17.32	17.60	19.66	5.7	370	19.54	5.7	370	17.62	18.21	19.19	19.10	19.28	19.22	18.42	18.36	18.37	18.30	17.60	17.97	17.62	17.98	120	110	
81	63	103	105	18.18	18.18	19.19	5.5	370	19.25	5.6	370	18.76	18.82	19.05	19.13	18.40	18.67	18.12	18.13	18.08	18.07	17.66	17.99	17.63	17.97	240	203	

BA 494/U Batteries, Lot 19, manufactured under Contract No. DAAB07-67-C-0313
 \bar{X} TRENDS FOR BATTERIES STORED AND TESTED AT 110°F



Battery Type BA 494/UType Test BENCHTime Fired 1050Position LAUNCHFirst Volt Ind. + 10 msRise Time (16.63) + 92 msMax. Volts + 19.66Time to Max. V. + 370 msLife to 16.63V + 120 secondsGround Power Off + 103 msSpecimen No. 9 YEAR 110°F STORAGELot No. 19S/N 00516E0867Date 1 NOVEMBER 1976Temp. 110°FFirst Volt In. - 7 msRise Time (16.63) - 83 msMax. Volts - 19.55Time to Max. V - 370 msLife to 16.63 V - 110 secondsGround Power off - 105 ms

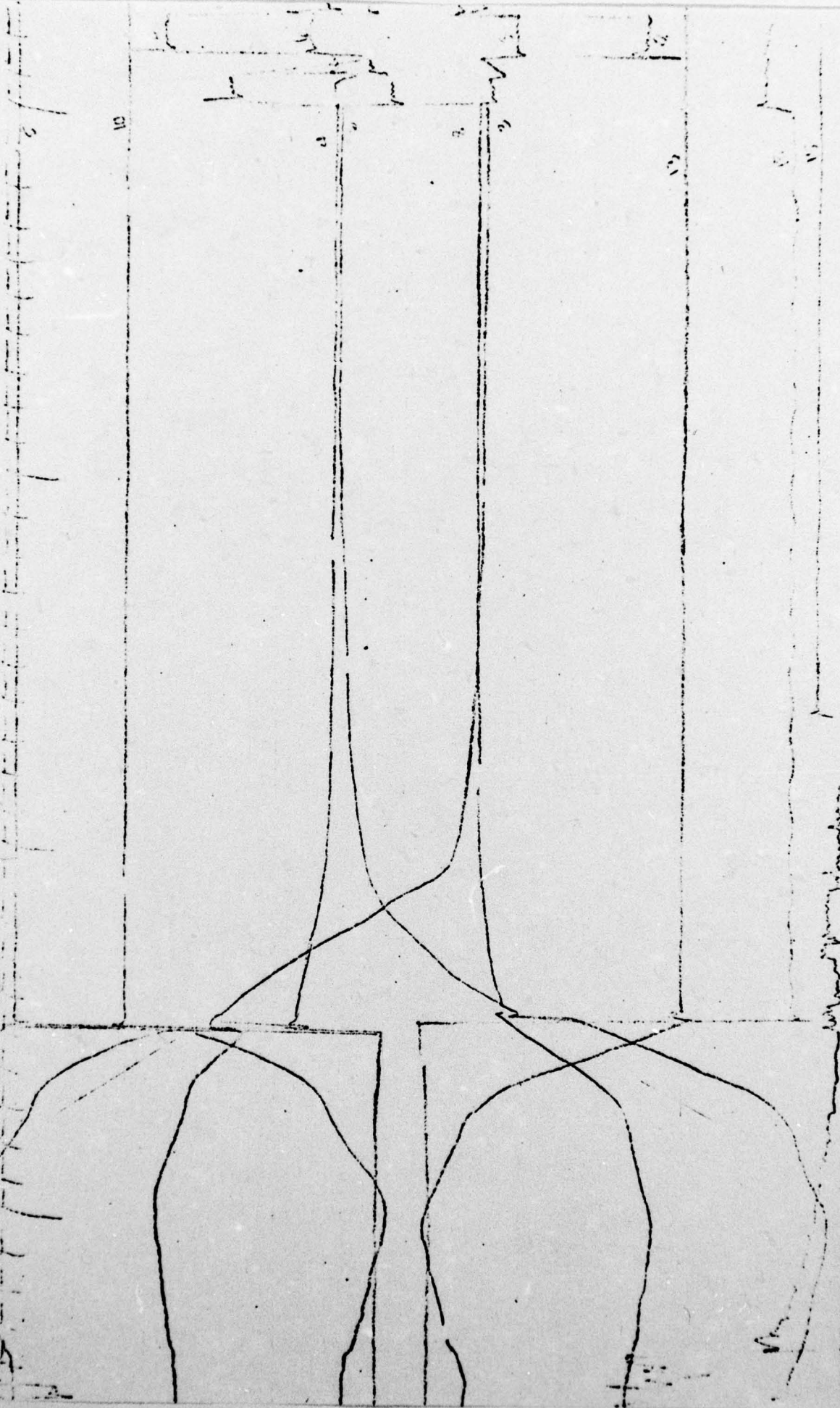
POSITIVE SECTION

Time	Min. Volts	Max. Volts	Min. Amps	Max. Amps
105 ms		17.36	10.8	
150 ms		19.19	12.0	
350 ms		19.30	12.3	
370 ms	19.18	19.66	5.7	11.9
2 sec.	18.78	19.28	5.6	17.6
4 sec.	18.31	18.81	5.45	17.2
9.8 sec.	17.83	18.31	5.3	16.7
10 sec.	17.91	18.27	6.4	14.2
30 sec.	17.6	17.97	6.35	13.9
50 sec.	17.55	17.90	6.2	13.8
57 sec.	17.54	17.90	6.2	13.8
100 sec.	17.3	17.64	6.1	13.7
110 sec.	17.1	17.47	6.0	13.5
150 sec.				
120 sec.	16.63	17.02	5.9	13.0
200 sec.				
250 sec.				
300 sec.				
350 sec.				

NEGATIVE SECTION

Min. Volts	Max. Volts	Min. Amps	Max. Amps
	17.90	11.2	
	19.10	12.1	
	19.41	12.2	
19.10	19.55	5.7	12.1
18.73	19.22	5.6	11.8
18.26	18.80	5.45	17.4
17.72	18.26	5.3	16.8
17.86	18.20	6.4	14.1
17.62	17.98	6.3	14.0
17.57	17.92	6.25	13.9
17.55	17.90	6.3	13.9
17.05	17.41	6.1	13.5
16.63	17.00	5.9	13.0

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S/N 0051650 887
LOT 19

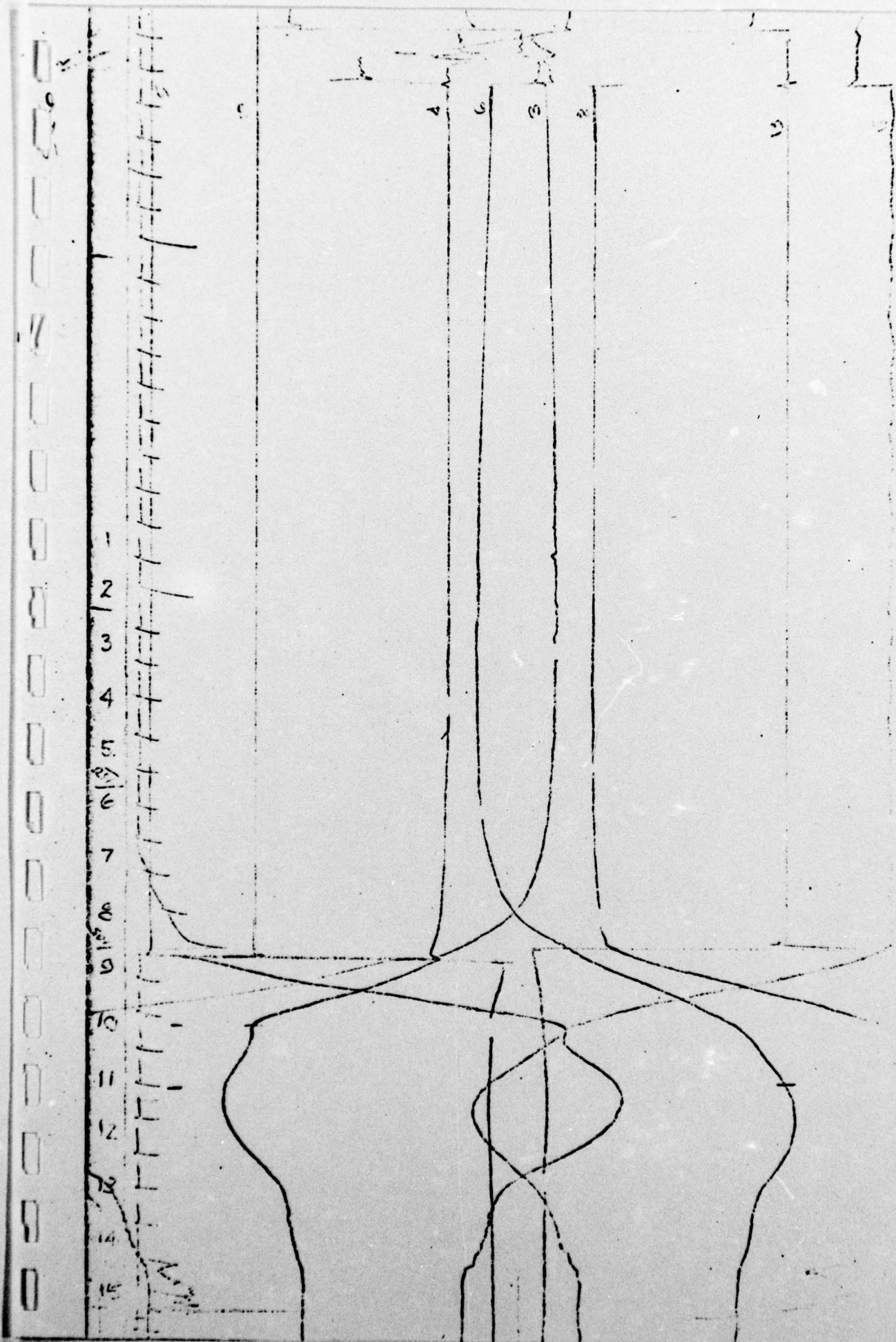
Battery Type BA 494/U
 Type Test BENCH
 Time Fired _____
 Position LAUNCH
 First Volt Ind. + 13 ms
 Rise Time (16.63) + 81 ms
 Max. Volts + 19.19
 Time to Max. V. + 370 ms
 Life to 16.63V + 240
 Ground Power Off + 103 ms
 Reverse Current + 4.2 A

Specimen No. 9 YEAR RT STORAGE

Lot. No. 19 EXTRA
 S/N 566 9/67
 Date 1 NOVEMBER
 Temp. Test: 110°F
 First Volt In. - 13 ms
 Rise Time (16.63) - 63 ms
 Max. Volts - 19.25
 Time to Max. V - 370 ms
 Life to 16.63 V - 203 sec.
 Ground Power off - 105 ms
 Reverse Current - 1.8 A

POSITIVE SECTION				
Time	Min. Volts	Max. Volts	Min. Amps	Max. Amps
105 ms		18.27	11.5	
150 ms		19.05	12.0	
350 ms		19.00	12.0	
370 ms		19.19	5.55	
2 sec.	18.02	18.46	5.3	16.9
4 sec.	17.75	18.20	5.25	16.8
9.8 sec.	17.65	18.11	5.2	16.6
10 sec.	17.77	18.08	6.4	14.0
30 sec.	17.66	17.99	6.25	14.0
50 sec.	17.64	17.98	6.25	14.0
57 sec.	17.66	17.95	6.25	14.0
100 sec.	17.69	18.0	6.25	14.0
150 sec.	17.64	17.94	6.25	14.0
200 sec.	17.41	17.72	6.2	13.8
203 sec.	17.40	17.70	6.15	13.7
240 sec.	16.625	17.93	5.85	13.1
300 sec.				
350 sec.				

NEGATIVE SECTION			
Min. Volts	Max. Volts	Min. Amps	Max. Amps
	18.41	11.5	
	19.13	12.0	
	19.06	12.1	
	19.25	5.6	
18.06	18.57	5.4	17.2
18.00	18.30	5.3	17.0
17.61	18.11	5.3	16.8
17.72	18.07	6.4	13.7
17.63	17.99	6.3	14.0
17.64	18.0	6.25	14.0
17.6	18.0	6.25	14.0
17.68	18.01	6.3	14.0
17.6	17.90	6.3	14.0
16.69	17.00	5.7	13.1
16.625	16.71	5.85	13.0



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LOT 19